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THE WORK OF THE UMATILLA RECLAMATION PROJECT EXPERIMENT FARM IN 1913.[1]

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INTRODUCTION.

The experiments carried on at the Umatilla Experiment Farm in 1913 followed the same general lines as those conducted in 1912, as reported in a previous publication.[2] On account of the small size of the farms on the Umatilla project—which contain an average of about 30 acres of irrigable land—it is necessary that systems of intensive agriculture be established. The climatic conditions on the project are well suited to the production of certain truck crops and fruits and to dairy farming. One of the first requirements of successful crop production on this project is to increase the supply of organic matter in the soil, so as to improve the water-holding capacity and productivity and to lessen the danger of wind erosion. It is necessary also that crop varieties suited to the conditions on the project be found and that satisfactory methods be worked out for handling the soil and the irrigation water.

Since its establishment in 1909, the Umatilla Experiment Farm has been devoted to the investigation of these problems. The work of the farm has been mainly horticultural and is at present confined

[1] The Umatilla Experiment Farm is located on the Umatilla Reclamation Project, about 2 miles north of Hermiston, Oreg. The farm contains 40 acres of land withdrawn from entry in 1908 by the Department of the Interior for use as an experiment farm. It is maintained by the Oregon Agricultural Experiment Station and operated in cooperation with the Bureau of Plant Industry, United States Department of Agriculture, under a cooperative agreement. Operations were begun in 1909. The buildings used were constructed by the United States Reclamation Service and by the Oregon Agricultural Experiment Station. The expenses of the farm are shared equally by the Oregon station and the Office of Western Irrigation Agriculture. The investigational work is under the immediate supervision of a farm superintendent, who is also a collaborator of the Bureau of Plant Industry.

[2] Allen, R. W. The work of the Umatilla Experiment Farm in 1912. U. S. Dept. of Agriculture, Bureau of Plant Industry Circular 129, p. 21–32, 1913.

chiefly to testing varieties of fruits and truck crops and to investigating methods of producing these crops, including methods of irrigation. The present publication contains a brief discussion of the progress of the work during the year 1913.

CONDITIONS ON THE PROJECT.

CLIMATIC CONDITIONS.

Measurements of precipitation, evaporation, wind velocity, and temperature have been made at the experiment farm in cooperation with the Biophysical Laboratory of the Bureau of Plant Industry since September, 1911. A summary of the climatological observations for the three years is given in Table I.

TABLE I.—*Summary of climatological observations at the Umatilla Experiment Farm from 1911 to 1913, inclusive.*

PRECIPITATION (INCHES).

Year.	Item.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
1911										0.55	0.46	0.48	0.50	
1912		2.22	0.67	0.49	0.61	1.25	0.97	0.05	1.18	.10	.29	.54	.13	8.50
1913		1.69	.57	.23	.34	1.72	.78	Tr.	.52	.16	1.43	1.20	.62	9.26
	Average.	1.95	.57	.36	.47	1.48	.87	.02	.85	.27	.72	.74	.41	

EVAPORATION (INCHES).

1912		(1)	(1)	(1)	3.98	5.21	7.51	8.23	5.68	3.87	2.98	.78	.25	38.50
1913		(1)	(1)	1.98	3.70	5.85	5.90	8.53	7.13	5.06	2.06	.70	(1)	40.9
	Average.				3.84	5.53	6.70	8.33	6.36	4.46	1.47	.74		

DAILY WIND VELOCITY (MILES PER HOUR).

1911	Mean								5.2	5.6	3.5	5.5	3.8	
1912	do	2.5	4.0	3.3	2.5	3.1	5.3	4.4	3.8	2.5	3.5	1.7	4.3	3.4
1913	do	3.1	2.5	4.7	5.2	3.7	4.5	3.8	3.0	2.2	2.3	2.1	1.2	3.3
1911	Maximum								13.2	13.7	19.8	14.8	16.2	19.8
1912	do	8.7	12.7	16.9	15.7	10.5	13.6	11.5	9.7	9.5	12.3	5.1	15.4	16.9
1913	do	15.3	6.9	13.9	14.2	11.8	9.8	11.9	7.0	8.2	8.3	11.5	3.3	15.3
1911	Minimum								1.8	1.4	.8	.7	.8	.8
1912	do	1.2	.9	1.3	1.1	.9	.9	1.2	.8	.5	.6	.7	.5	.5
1913	do	.8	.5	1.0	1.4	1.1	1.3	.9	.5	.4	.4	.5	.3	.3

MONTHLY TEMPERATURE (°F.).

1911	Mean									54	48	37	34	
1912	do	29	40	41	52	61	69	72	69	59	48	42	35	
1913	do	30	23	45	53	59	68	74	83	60	50	43	31	
1911	Maximum									79	89	66	55	
1912	do	52	58	71	78	91	104	102	102	87	78	62	63	104
1913	do	66	60	64	86	87	97	105	103	91	81	65	51	105
1911	Minimum									28	15	9	12	
1912	do	−18	16	15	26	35	43	48	41	32	23	20	12	−18
1913	do	0	− 6	19	26	34	44	44	42	31	26	25	7	− 6

[1] Record incomplete, owing to freezing of water.

The dates of the last spring frosts and first autumn frosts from 1909 to 1911, inclusive, were obtained from the local office of the Reclamation Service at Hermiston, about 2 miles from the experiment farm. In 1912 and 1913 the observations were made at the farm. These data for the five years 1909 to 1913, inclusive, are given in Table II.

TABLE II.—*Killing frosts at Hermiston, Oreg., 1909 to 1913, inclusive.*

Year.	Last in spring.		First in autumn.		Frost-free period.
	Date.	Minimum temperature.	Date.	Minimum temperature.	
		° F.		° F.	*Days.*
1909	Apr. 21	27	Oct. 16	30	178
1910	Apr. 30	27	Oct. 15	31	168
1911	Apr. 20	31	Sept. 23	26	156
1912	Apr. 16	31	Oct. 6	31	173
1913	Apr. 23	28	Sept. 24	31	153
Average					165

AGRICULTURAL CONDITIONS.

The season of 1913 was especially favorable for crop production, the number of heavy winds and hot days being relatively few. A hot wave which occurred late in July checked temporarily the growth of the more tender crops of the project, but was not serious. A light frost occurred on September 24, but did very little damage. Continuous cold weather did not begin until unusually late, so that fall-planted crops had very favorable growing conditions.

In 1913 the total irrigable area of the 311 farms on the project was 10,092 acres. Of this, an area of 4,994 acres was actually irrigated. The average irrigated area per farm was about 16 acres. Of the land actually irrigated, an area of 1,961 acres was devoted to young orchards, newly seeded alfalfa, rye for green manure, and other crops not harvested, so that the total area from which crops were harvested was 3,033 acres. This area was about 200 acres less than the area harvested in 1912. The average farm value per acre of all the crops on the project was $27.72 in 1913, as compared with $24 in 1912. The acreage, yields, and farm values of the crops grown on the project in 1913 are stated in Table III, the figures being obtained from the United States Reclamation Service.

TABLE III.—*Acreage, yields, and farm values of crops grown on the Umatilla project in 1913.*

Crop.	Area (acres).	Unit of yield.	Yield.			Farm value.			
			Total.	Per acre.		Per unit of yield.	Total.	Per acre.	
				Average.	Maximum.			Average.	Maximum.
Alfalfa hay	2,024	Ton	8,010	3.96	10	$8.00	$64,080	$31.66	$80.00
Clover hay	20	do	34	1.7	4	7.35	250	12.50	29.40
Other hay	42	do	38	.90	2	6.00	228	5.43	
Apples	11	Pound	1,800	163.6	800	.04	72	6.50	32.00
Apricots	6	do	4,320	720.0	1,600	.05	216	36.00	330.00
Artichokes	9	Ton	119	13.2	25	10.00	1,170	132.00	250.00
Corn	56	Bushel	1,088	19.43	85	.84	914	16.32	
Corn fodder	76	Ton	212	2.79	8	3.75	795	10.45	
Watermelons	13	Pound	139,000	10,692	16,000	.075	1,042	80.15	
Fruit, small	36	do	22,141	615	5,760	.09	1,993	55.33	
Grapes	91	do	38,820	426.6	25,000	.02	776	8.53	
Garden	59						2,835	48.05	
Onions	3	Bushel	436	145.3	600	.50	218	72.67	300.00
Pasture	496						3,297	6.65	
Peaches	87	Pound	62,200	715.0	6,000	.022	1,368	15.72	132.00
Potatoes	83	Bushel	7,538	90.8	533	.64	4,824	58.12	
Less duplications	79								
Total	3,033						84,078		
Average value								27.72	

MARKETING CONDITIONS.

Marketing conditions on the project, while somewhat better than in 1912, were not entirely satisfactory. The first peach crop was harvested and marketed at considerable disadvantage, owing to its not being of sufficient size to warrant the assembling of carload lots and to the glutted condition of local markets. Early potatoes, which could not be disposed of in 1912, brought a fair price early in the season of 1913, but a quick decline made it impossible to dispose of all the crop at profitable prices. Watermelons shipped in carload lots brought as much as three-fourths of a cent a pound. The distance to market makes it important for fruit and vegetables to be shipped regularly and in uniform condition, which is impossible without a local organization to assemble and grade the products before shipping. Such an organization could also prevent wasteful competition between neighbors in the nearer markets.

The rapid increase in the number of dairy cattle on the project made it possible to dispose of a large part of the 1913 crop of hay by feeding it on the farms. The prices thus obtained were higher than those previously received for the hay. The output of the local creamery increased 270 per cent during the 10 months since it began operations. A total of 83,285 pounds of butter was manufactured during this time and an average of 35 cents per pound was paid for butter fat. An increased area of land was pastured by hogs and the returns were far above the commercial value of hay which the pastured land would have produced. The hay crop sold out early at $6.50 to $7 in the stack and $9 to $9.50 baled and loaded

on cars for shipment. The demand for baled hay continued, and the price advanced to $11 per ton later in the season.

FIELD EXPERIMENTS.

The principal lines of work along which experiments were conducted on the farm in 1913 are as follows: (1) The testing of fruit varieties and methods of their production; (2) the testing of varieties

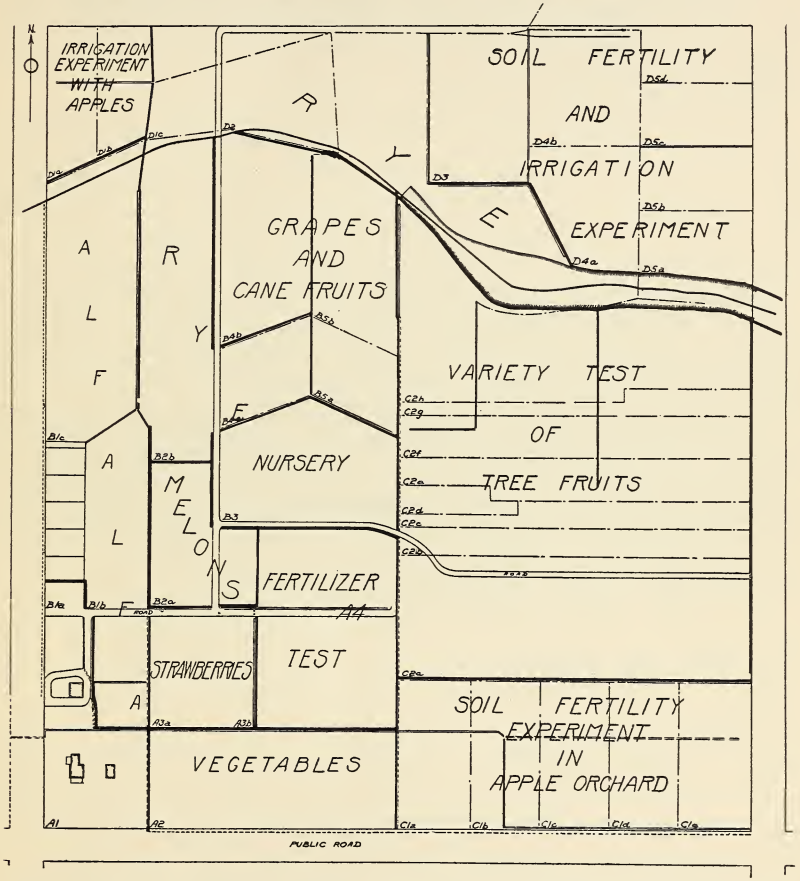

FIG. 1.—Diagram of the Umatilla Experiment Farm, showing the arrangement of the fields and the location of the experiments in 1913.

of garden and truck crops; (3) experiments with methods of increasing the supply of organic matter in the soil; (4) the testing of a number of green-manure crops and methods of handling them; (5) growing numerous hardy trees and shrubs to find their value for ornamental purposes and as windbreaks; and (6) continued testing of different irrigation methods. The arrangement of the fields and the locations of the experiments in 1913 are shown in figure 1.

Some valuable results have been obtained from these experiments, and some of the more important are briefly reviewed here. The results of these experiments are in most cases not given as final, but as a statement of the progress so far made. The methods of tillage have in no case been other than can be followed by any farmer on the project.

EXPERIMENTS WITH FRUITS.

Variety tests of tree fruits.—The principal experiments with fruits are tests of varieties, of which but few have as yet fruited. The success in starting trees and their subsequent growth have varied greatly with the different kinds.

Practically all varieties of apples have been found to be hardy and have made a fair growth. The hardy, large-growing varieties, such as McIntosh, Winesap, and Gravenstein, and the Transcendent crab have grown more rapidly than others under similar conditions. The Hyslop, Martha, and Yellow Siberian crab apples blossomed in their fourth year, 1913, showing a tendency toward early fruiting.

The growth of the pear varieties has been very slow, but was much better in 1913 than previously. Their behavior indicates that they require considerable time to get established when set out on new land. Quinces have behaved much the same as pears.

The growth of prunes and plums shows a wide range of adaptability between different varieties. The Peach plum, Sergeant (*Robe de Sergeant*), Lombard, and Maynard are quite hardy and have grown rapidly, attaining in four years a height of 6 to 10 feet. Some of the better commercial varieties of prunes are more difficult to grow, especially the Italian (*Fellenberg*) and Hungarian.

The variety test of cherries is located on a steep, south exposure. The growth of the trees has been very slow, and several trees have died. The sour varieties of the Duke and the Morello groups appear to be more hardy than the sweet varieties of the Heart and the Biggareau groups. In 1913 several varieties blossomed early and set a large amount of fruit, which was removed to relieve the trees.

The peach, nectarine, and apricot trees are also located on a steep south hillside where considerable grading was done in preparing the land for irrigation. The growth of the different varieties is fairly uniform, but varies somewhat because of the uneven character of the soil resulting from grading. The average height of peach trees in their fourth year was $4\frac{3}{4}$ feet. A large number of varieties blossomed in 1913 but only a few set fruit, as the blossoms were destroyed by frost on April 23. The slow growth of these trees is to be attributed to their exposure to the sun and wind and to the infertile soil on which they are located.

Methods of planting strawberries.—To test the four common field methods of planting strawberries, namely, the double hedgerow sys-

tem, the single hedgerow system, the matted-row system, and the hill system, an experiment has been conducted for three years. Plants of the Clark (*Clark's Seedling*) variety were planted in September, 1910, on newly graded land, one-eighth of an acre being planted by each method. Table IV shows the number of plants on each plat and the average yields of two crops.

TABLE IV.—*Strawberry plants required to plant ⅛-acre plats by different methods and their average yields at the Umatilla Experiment Farm in 1912 and 1913.*

Method of planting.	On ⅛-acre plat.	Average yield per acre, 1912 and 1913.
	Plants.	*Quarts.*
Double hedgerow system	2,400	784
Single hedgerow system	1,400	528
Matted-row system	930	268
Hill system	930	248

The production of fruit in relation to the area of land occupied by each plant is in favor of the single hedgerow system, but the heaviest yield per acre was obtained from the double hedgerow planting. The hill system of planting is the most economical to handle, as the plants are kept apart, which facilitates removing runners and keeping out weeds. The small growth of plants and light yield of fruit in this experiment are attributed to the infertile condition of the soil.

Promising varieties of strawberries.—Of the 74 strawberry varieties under trial, those named in Table V have given the best results.

TABLE V.—*Dates of blossoming and fruiting and yields per acre of the more promising varieties of strawberries at the Umatilla Experiment Farm in 1913.*

Variety.	First blossoms.	First fruit.	Yield per acre.
			Pounds.
Parson	April 20	May 23	3,662
Crescent	April 19	do	3,301
Texas	April 24	do	1,678
Arizona	April 22	May 24	1,583
Miller	do	do	1,010
Kansas	April 20	June 3	953
Clark	April 21	May 19	227

Although far inferior in point of yield, the Clark is valuable on account of its early maturity and superior shipping quality. The other varieties are rather soft and inferior for marketing. The Texas, Kansas, and Parson can be shipped successfully to local markets.

Gooseberries.—The following varieties of gooseberries were grown in 1913: Downing, Industry, Josselyn, Oregon, Pearl, Smith, Victoria, and Houghton. Houghton and Smith, red varieties, and the Victoria, a white variety, have proved the most hardy and productive.

Grapes.—Of the few varieties of grapes that fruited in 1913, the Worden is far superior, as it is a vigorous plant and produces abundantly a fruit of very high quality. The Diamond, Agawam, Catawba, Campbell, and Concord are promising varieties. The American varieties appear to be well adapted to the conditions on the project on account of their late blossoming and adaptability to light soils. The quality of the fruit is very good, being sweet and highly flavored, and the fruit matures early.

On account of their requiring winter protection and a long warm season to mature their fruit successfully and from their susceptibility to crown-gall, the Viniferas (California grapes) are not as well adapted to the district as the American varieties. Both do well, however, and their production should be extended.

GARDEN AND TRUCK CROPS.

Garden-frame experiment.—An experiment was carried on to determine the value of garden frames in starting tender vegetables in the field before danger of frost is past. The experiment included eggplants, watermelons, and cantaloupes. Half the frames were covered with burlap and the others with glass. Fresh horse manure was put under some of the burlap and glass-covered frames to furnish a small amount of heat and as a fertilizer. Fifteen hills were planted under each of the four conditions. Table VI shows in detail the results of this experiment, and figure 2 shows the frames placed in the field.

TABLE VI.—*Results of the garden-frame experiment at the Umatilla Experiment Farm in 1913.*

Crop.	With manure.		Without manure.	
	Under glass.	Under burlap.	Under glass.	Under burlap.
Eggplants:				
Number of hills developed	7	6	6	3
First ripe fruit	Aug. 15	Aug. 20	Sept. 12	.....
Number of fruits	77	33	7	0
Weight.....pounds..	23.5	16.5	3.5	0
Watermelons:				
Number of hills developed	5	8	9	9
First ripe fruit	July 29	Aug. 11	July 30	Aug. 3
Number of fruits	18	10	17	11
Weight.....pounds..	194	100	131	102
Cantaloupes:				
Number of hills developed	15	7	15	6
First ripe fruit	July 24	.....	July 21	July 30
Number of fruits	138	12	80	16
Salable fruits	37	2	9	6

The results of this experiment show that the covering of glass and the use of manure under the seed and plants are of distinct value. The eggplants did better with the burlap covering and manure than with the glass covering without manure, while the melons each gave

better results under the glass and without manure than with the burlap covering and manure. The results suggest (1) the value of a glass covering and a deposit of fresh manure under hills of eggplants, watermelons, and cantaloupes, (2) a less marked value of manure for watermelons and cantaloupes than for eggplants, and (3) the value of manure under eggplant hills. The use of glass and manure in starting these crops in the field before danger of frost is past appears to be advisable, or at least worthy of trial.

Eggplants.—Three varieties of eggplant were grown in 1913. This is the third year this crop has been produced on the experiment farm. A heavy yield of fruit of good quality was obtained. Of the varieties grown, the Black Beauty and New York Improved are considered the best, on account of their heavier production and the more uniform size and shape of fruit. The increased demand for this crop, which

FIG. 2.—Garden frames used at the Umatilla Experiment Farm in 1913 to determine their value in protecting tender plants from frost. Young plants were protected from injury against 4 degrees of frost by these frames.

grows well on the Umatilla project, warrants more extensive production. Some difficulty in selling will be encountered for a time, but this will be greatly diminished when it is known that good eggplants are being produced in the district and markets are established.

Potatoes.—The 14 varieties of potatoes grown in 1913 to determine their comparative value are the American Wonder, Burbank, Early Ohio, Early Rose, Factor, Green Mountain, Irish Cobbler, Mechanic, Netted Gem, Peachblow (red), Pearl, Rural, Somers, and Up-to-Date.

The highest yields obtained were at the following rates per acre: American Wonder, 142.4 bushels; Netted Gem, 133 bushels; Pearl, 126.3 bushels; and Early Ohio, 116 bushels.

Peanuts.—The yields of peanuts in 1913 were at the following rates per acre: African, 28.4 bushels; Jumbo (large seed of Virginia), 26 bushels; Spanish, 10.6 bushels; Valencia, 10.2 bushels; and Virginia (*Virginia Bush*, or *Virginia Runner*), 8 bushels. An average yield

of peanuts in a commercial growing district is 30 bushels per acre. The standard weight per bushel for Spanish is 30 pounds; for Virginia, 22 pounds.

The yield of African peanuts obtained in 1913 at the experiment farm compares favorably with the average crop yield in commercial peanut-growing districts. However, the cost of production is higher on irrigated land, on account of the higher cost of land and the greater amount of labor required to grow the crop. The season at Hermiston appears to be too short to mature a full crop of peanuts, as has been shown in each of the three years of this test. The commercial production of peanuts on the project is not feasible with the varieties used in the Southeastern States, but the results of the above experiment demonstrate that they can be successfully grown on a small scale and for home use.

Corn.—Seven varieties of corn were grown to determine their value for grain production and for silage. The yields in pounds per acre of cured grain and stover combined were at the following rates: Stowell's Evergreen, 5,683; Pride of the North, 5,073; Disco White Dent, 4,146; Leaming, 2,974; Minnesota No. 13, 2,717; Stanford White Flint, 2,593; and Minnesota No. 23, 1,891. The average yield of the seven varieties was 3,582 pounds per acre.

All the varieties but Stowell's Evergreen were thinned, leaving two stalks to the hill. The best combination of grain and stover production was obtained with Pride of the North, which produced a large quantity of stover and a high yield of grain. On account of its heavy yield, it is suitable for grain production and also for silage, as a high percentage of grain is desirable in silage corn. From the present knowledge of corn varieties for light soils, it appears that this is one of the very best and that it is a very desirable variety from which to select seed and build up strains that are better adapted to the locality.

SOIL-FERTILITY EXPERIMENTS.

To determine the best and most economical method of increasing the fertility of the soil on the project, which in its virgin condition is very low in fertility, several experiments are being conducted. One line of work seeks to determine the value of commercial fertilizers and the other to determine the rapidity with which green-manure crops will build up the soil and increase its crop-producing power.

Commercial fertilizers.—The commercial-fertilizer experiment which is being made has not progressed far enough to warrant comparisons between the various fertilizers used. Fertilizers containing nitrogen and organic matter have stimulated the crop growth on the land to which they have been applied, indicating that the addition of these materials is of considerable benefit. Chemical analyses show that the soils of the district are low in nitrogen and organic matter, and the

increase in supply of these materials can be expected to increase the vigor of crops. No consistent increases in crop yield have as yet resulted from the application of potash or phosphatic fertilizers.

Green manuring.—Land on which two or three crops of hairy vetch have been grown and plowed under shows a marked improvement in the physical condition of the soil and in crop-producing power. The lateral spread of water through the soil is much more rapid and extensive. Irrigation becomes less troublesome, from the reduced amount of washing and greater rapidity with which the water can be handled. This work demonstrates the value of nitrogenous and organic fertilizers, such as nitrogen tankage, stable manure, and leguminous green-manure crops, all of which produce a decided increase in crop growth on land to which they are applied at the experiment farm.

GREEN-MANURE CROPS.

A number of crops are being tried at the experiment farm to determine their value for use as green manure to increase the fertility of the soil.

Green-manure crops can be grown as winter cover crops or summer shade crops. When winter cover crops are grown the land can be devoted to a salable crop in the summer.

Three varieties of vetch—spring or common vetch (*Vicia sativa*), scarlet vetch (*V. dasycarpa*), and hairy vetch (*V. villosa*)—have been tried. *V. sativa* winterkills and is not desirable for fall planting. *V. dasycarpa* is fairly hardy, but does not produce as heavy a crop as *V. villosa*.

Of a large number of crops grown to determine their value for green manure, hairy vetch (*Vicia villosa*) has been much the best. (See fig. 3.) It should be sown in August or September at the rate of 15 to 25 pounds of seed per acre. By allowing strips of the first crop to mature, the ground can be reseeded by scattering the unthrashed seed-bearing plants over the field and working them into the soil. By this method the annual purchase of expensive seed is avoided. That this method is practicable was demonstrated by the results obtained on the experiment farm in 1913.

Several trials have been made with Canada field peas, one with soy beans, and three with sweet clover. It has been demonstrated that these crops can be grown to advantage in the spring and summer. Field peas should be sown early in March at the rate of 100 pounds per acre. Sweet clover can be sown at any time during the irrigating season at the rate of 20 pounds per acre. If it is planted during April or early May, a crop can be plowed under as green manure at the close of the first summer. If the planting is done later than May, comparatively little growth can be obtained before the following year.

Soy beans were tried in 1913 and promise to be a very good summer green-manure crop. (See fig. 4.) At no time during their growth could nodules be found on the roots, so it is probable that they will do better if inoculated with the proper culture of bacteria.

Crimson clover has been tried in both spring and summer without success. The fall-sown crop grew slowly for a time, but did not survive the winter. Spring-sown plants grew fairly well during cool weather, but when warm weather came they soon died out, evidently from the effect of heat, as the land was kept moist by irrigation.

A number of experiments were begun in the fall of 1913 to determine (1) the proper amount of hairy vetch (*Vicia villosa*) seed to sow to insure a good crop of green manure, (2) the most desirable proportions of rye and vetch seed to sow in mixtures used for cover-crop pur-

FIG. 3.—Vetch (*Vicia villosa*) and rye in field C1a, Umatilla Experiment Farm, May 10, 1913, showing a heavy growth of this mixed crop, which was sown in September, 1912.

poses, (3) the effect of sowing hairy vetch in the fall without irrigation, and (4) the value of hairy vetch as a seed crop and whether the seed can be successfully harvested. The results of these experiments will not be known until the summer of 1914.

ORNAMENTAL TREES AND SHRUBS.

The tests of ornamental plants have shown a number of very desirable individuals to be worthy of recommendation. *Hydrangea paniculata* and *Spiraea prunifolia* are very hardy and desirable shrubs. Privet (*Ligustrum vulgare*) and Russian oleaster (*Elaeagnus angustifolia*) are hardy and desirable for hedges and windbreaks. Three varieties of Tamarix, *T. gallica*, *T. germanica*, and *T. hispida*, are desirable hardy plants which attain heights of 6 to 10 feet. The American elm (*Ulmus americana*), the white or silver maple (*Acer sacchari-*

num), and the sycamore (*Platanus occidentalis*) are promising trees for shade and ornamental purposes. The Rocky Mountain silver cedar is a very attractive and apparently hardy evergreen. The western yellow pine (*Pinus ponderosa*) and the Scotch pine (*P. sylvestris*) are very hardy and give promise of being valuable for ornamental and windbreak purposes.

IRRIGATION METHODS.

Considerable work has been done on the farm to determine the best methods of handling water in irrigating different crops, and observations have been made on methods in practice on the project. Each succeeding year's work on the farm and observations made of irrigation practices on the project emphasize the importance (1) of using short irrigation furrows ranging from 100 to 200 feet in length; (2) of making irrigation furrows from 20 to 30 inches apart; (3) of

FIG. 4.—Soy beans in field C1b, Umatilla Experiment Farm, September 15, 1913, showing a heavy growth without inoculation. These beans are a promising summer crop on account of their heavy growth and their ability to withstand considerable drought.

using fairly shallow furrows, well opened, to facilitate the flow of water; (4) of running water for but a short time in one place, as losses soon occur from deep percolation; (5) of the use of a small amount of water for each irrigation, since the storage capacity of the soil is very low; (6) of the frequent application of water to maintain an adequate supply for plant growth, as the small quantity that it is possible to store in the soil is rapidly removed by plant action, evaporation, and percolation; (7) of using a large stream of water while irrigating, to hasten the operation and diminish the loss from deep percolation that results from allowing the flow to continue too long in one place, and to diminish the labor of applying the water; (8) of furrowing alfalfa fields for irrigation after each crop is harvested; and (9) of the use of flumes, concrete-lined ditches, or pipe lines for conveying the water to the fields, to prevent the heavy losses in the distribution of the water.

Where water is allowed to stand for a long period over porous soil, heavy losses result. The water-holding capacity of a soil and the rapidity with which water moves through it vary with the size of the particles composing the soil. The coarser the soil the lower its capacity to hold water, and consequently the more frequent irrigation it requires. The frequency of irrigation necessary for a coarse soil varies with its storage capacity, which diminishes as the size of the particles increases.

COMMUNITY BREEDING OF DAIRY CATTLE.

It is recognized that one of the best methods of increasing the productivity of the soils of the project is to feed live stock on the farms and apply the manure to the land. With this point in view, a large number of farmers on the project have recently started in the dairy business. To assist the settlers in this enterprise and to aid in improving the quality of the dairy cattle, the Oregon Agricultural Experiment Station maintained a highly bred Jersey bull at the experiment farm in 1913. During the year free service was furnished for 122 cows.

EXTENSION WORK.

The staff of the farm devotes considerable time to extension work on the Umatilla and neighboring projects. In 1913 a number of lectures were given on subjects relating to the agricultural problems of the district, and frequent trips were made over the project to investigate difficult conditions which the farmers had encountered.

Four pruning demonstrations were held during the year, at which the pruning of apples, peaches, and grapes was discussed. Two of these demonstrations were held at the experiment farm. One was held on March 1, when the pruning of apple trees was demonstrated, and the other on October 31, to discuss pruning and covering grapes. Two demonstrations were held at Stanfield, the first on March 13, when the pruning of apples and peaches was demonstrated, and the second on November 10, when the pruning and covering of Vinifera grapes were discussed. An experiment-station field day was held on September 9, at which over 200 farmers were present. All the experiments in progress were fully explained and the results discussed. In all, 321 farmers were brought together during the year for outside demonstration work.

Approved:

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